CLAIMS

WHAT IS CLAIMED IS:

1.   An implantable medical device (IMD) for implantation in a patient, comprising pacing circuitry configured to selectively produce pacing pulses at a programmable pacing rate for delivery to muscle tissue of a heart of the patient, wherein the IMD is configurable to subject the patient to a stress test, and wherein during the stress test: (i) the pacing rate is increased from a start rate to a stop rate, wherein the stop rate is greater than the start rate, and (ii) stress test data is acquired and stored within the IMD.

2.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is configurable to store timing information specifying a time the IMD is to subject the patient to the stress test, and to subject the patient to the stress test at the time specified by the timing information.

3.   The implantable medical device (IMD) as recited in claim 2, wherein the timing information specifies a frequency and a time of day the IMD is to subject the patient to the stress test.

4.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is adapted to receive a signal, and configurable to subject the patient to the stress test in response to the signal.

5.   The implantable medical device (IMD) as recited in claim 4, wherein the signal is a radio frequency signal.

6.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is configurable to detect at least one sign of myocardial ischemia within the patient during the stress test, and wherein the IMD is configurable to abort the stress test when the at least one sign of myocardial ischemia is detected within the patient.

7.   The implantable medical device (IMD) as recited in claim 6, wherein the at least one sign of myocardial ischemia comprises deviation of an ST segment of an electrogram (EGM) waveform from an isoelectric baseline of the electrogram (EGM) waveform.

8.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is adapted to receive a signal, and configurable to abort a stress test in progress at a time the signal is received.

9.   The implantable medical device (IMD) as recited in claim 8, wherein the signal is a radio frequency signal.

10.   The implantable medical device (IMD) as recited in claim 1, wherein during the stress test, the pacing rate is monotonically increased from the start rate to the stop rate.

11.   The implantable medical device (IMD) as recited in claim 1, wherein during the stress test, the pacing rate is increased from the start rate to the stop rate by: (i) programming the pacing rate to be the start rate, and (ii) at pre-selected time intervals, reprogramming the pacing rate to be a sum of a current value of the pacing rate and a pre-selected rate-of-change value.

12.   The implantable medical device (IMD) as recited in claim 1, wherein the stress test data comprises electrogram (EGM) waveform data produced within the IMD.

13.   The implantable medical device (IMD) as recited in claim 12, wherein the IMD is coupled to receive a signal from at least one intrathoracic electrode, and wherein the electrogram (EGM) waveform is an intrathoracic electrogram (EGM) waveform.

14.   The implantable medical device (IMD) as recited in claim 12, wherein the IMD is coupled to receive a signal generated within the heart, and wherein the electrogram (EGM) waveform is an intracardiac electrogram (EGM) waveform.

15.   The implantable medical device (IMD) as recited in claim 12, wherein the electrogram (EGM) waveform comprises an ST segment and an isoelectric baseline, and wherein the EGM data comprises a measurement of deviation of the ST segment from the isoelectric baseline.

16.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is coupled to receive sensor data, and wherein the stress test data comprises the sensor data.

17.   The implantable medical device (IMD) as recited in claim 1, wherein the stress test data comprises pacing threshold data produced within the IMD and indicative of an amount of energy dissipated by the pacing circuitry while producing the pacing pulses.

18.   The implantable medical device (IMD) as recited in claim 1, wherein the stress test data comprises arrhythmia data produced within the IMD and indicative of detected arrhythmias of the heart of the patient.

19.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is coupled to receive a first intrinsic depolarization signal and a second intrinsic depolarization signal from the heart of the patient, and wherein the IMD is configurable to operate in a demand mode, and wherein in the demand mode, if the second intrinsic depolarization signal is not received within a predetermined time period, determined by the pacing rate, after the first intrinsic depolarization signal is received, the pacing circuitry is signaled to produce one of the pacing pulses.

20.   The implantable medical device (IMD) as recited in claim 1, wherein during an initial portion of the stress test: (i) the pacing rate is programmed such that the

pacing rate is increased from a start rate to a stop rate, and (ii) stress test data is acquired and stored within the IMD, and wherein during a final portion of the stress test: (iii) the pacing rate is programmed such that the pacing rate is decreased from the stop rate to the start rate, and (iv) the IMD provides the stress test data stored within the IMD.

21.   The implantable medical device (IMD) as recited in claim 1, wherein the IMD is a pacemaker.

22.   The implantable medical device (IMD) as recited in claim 1, wherein pacing pulses received by the muscle tissue of the heart cause the muscle tissue to depolarize.

23.   An implantable medical device for implantation in a patient, comprising:
        pacing circuitry configured to selectively produce pacing pulses at a
                programmable pacing rate for delivery to muscle tissue of a heart of
                the patient;
        a memory for storing data; and
        a control unit coupled to the pacing circuitry and the memory, wherein the
                control unit is configurable to subject the patient to a stress test, and
                wherein during the stress test the control unit: (i) programs the pacing
                rate such that the pacing rate is increased from a start rate to a stop
                rate, wherein the stop rate is greater than the start rate, and (ii) acquires
                and stores stress test data in the memory.

24.   The implantable medical device (IMD) as recited in claim 23, further comprising:
        a real time clock circuit coupled to the control unit and configured to keep
                track of time; and
        a telemetry unit coupled to the control unit and configured to send and receive
                signals and data; and
        wherein the control unit is configurable to: (i) receive timing data via the
                telemetry unit, wherein the timing data specifies a time the IMD is to

subject the patient to the stress test, and (ii) use the real time clock circuit to subject the patient to the stress test at the time specified by the timing data.

25.   The implantable medical device (IMD) as recited in claim 24, wherein the timing data specifies a frequency and a time of day the IMD is to subject the patient to the stress test.

26.   The implantable medical device (IMD) as recited in claim 23, further comprising a telemetry unit coupled to the control unit and configured to send and receive signals and data, wherein the control unit is configurable to subject the patient to the stress test in response to a signal received via the telemetry unit.

27.   The implantable medical device (IMD) as recited in claim 26, wherein the signal is a radio frequency signal.

28.   The implantable medical device (IMD) as recited in claim 23, wherein the control unit is configurable to detect at least one sign of myocardial ischemia within the patient during the stress test, and wherein the control unit is configurable to abort the stress test when the at least one sign of myocardial ischemia is detected within the patient.

29.   The implantable medical device (IMD) as recited in claim 28, wherein the at least one sign of myocardial ischemia comprises deviation of an ST segment of an electrogram (EGM) waveform from an isoelectric baseline of the electrogram (EGM) waveform.

30.   The implantable medical device (IMD) as recited in claim 23, further comprising a telemetry unit coupled to the control unit and configured to send and receive signals and data, wherein the control unit is configurable to abort a stress test in progress at a time a signal is received via the telemetry unit.

31.   The implantable medical device (IMD) as recited in claim 30, wherein the signal is a radio frequency signal.

32.   The implantable medical device (IMD) as recited in claim 23, wherein during the stress test, the control unit programs the pacing rate such that the pacing rate is monotonically increased from the start rate to the stop rate.

33.   The implantable medical device (IMD) as recited in claim 23, wherein during the stress test, the control unit: (i) programs the pacing rate to be the start rate, and (ii) at pre-selected time intervals, reprograms the pacing rate to be a sum of a current value of the pacing rate and a pre-selected rate-of-change value.

34.   The implantable medical device (IMD) as recited in claim 23, further comprising electrode sensing circuitry coupled to receive electrode signals and configured to produce electrogram (EGM) waveform data derived from an electrogram (EGM) waveform, wherein the stress test data comprises the electrogram (EGM) waveform data.

35.   The implantable medical device (IMD) as recited in claim 34, wherein the electrode sensing circuitry is coupled to receive electrode signals from at least one intrathoracic electrode and configured to produce intrathoracic electrogram (EGM) waveform data, and wherein the stress test data comprises the intrathoracic electrogram (EGM) waveform data.

36.   The implantable medical device (IMD) as recited in claim 34, wherein the electrode sensing circuitry is coupled to receive electrode signals from at least one intracardiac electrode and configured to produce intracardiac electrogram (EGM) waveform data, and wherein the stress test data comprises the intracardiac electrogram (EGM) waveform data.

37.   The implantable medical device (IMD) as recited in claim 34, wherein the electrogram (EGM) waveform comprises an ST segment and an isoelectric baseline,

and wherein the electrogram (EGM) waveform data comprises data indicative of a deviation of the ST segment from the isoelectric baseline.

38.   The implantable medical device (IMD) as recited in claim 23, wherein the control unit is coupled to receive sensor data, and wherein the stress test data comprises the sensor data.

39.   The implantable medical device (IMD) as recited in claim 23, wherein the control unit is coupled to receive pacing threshold data produced within the IMD and indicative of an amount of energy dissipated by the pacing circuitry while producing the pacing pulses, and wherein the stress test data comprises the pacing threshold data.

40.   The implantable medical device (IMD) as recited in claim 23, wherein the control unit is coupled to receive arrhythmia data produced within the IMD and indicative of detected arrhythmias of the heart of the patient, and wherein the stress test data comprises the arrhythmia data.

41.   The implantable medical device (IMD) as recited in claim 23, further comprising timing/pacing control circuitry coupled to receive a first intrinsic depolarization signal and a second intrinsic depolarization signal from the heart of the patient, wherein the IMD is programmable to operate in a demand mode, and wherein in the demand mode, if the timing/pacing control circuitry does not receive the second intrinsic depolarization signal within a predetermined time period, determined by the pacing rate, after the timing/pacing control circuitry receives the first intrinsic depolarization signal, the timing/pacing control circuitry is configured to signal the pacing circuitry to produce one of the pacing pulses.

42.   The implantable medical device (IMD) as recited in claim 23, further comprising a telemetry unit coupled to the control unit and configured to send and receive signals and data, wherein during an initial portion of the stress test, the control unit: (i) programs the pacing rate such that the pacing rate is increased from the start

rate to the stop rate, and (ii) acquires and stores the stress test data in the memory, and wherein during a final portion of the stress test, the control unit: (iii) programs the pacing rate such that the pacing rate is decreased from the stop rate to the start rate, and (iv) provides the stress test data stored in the memory via the telemetry unit.

43.   A system, comprising:

a programming unit configured to produce a first signal;

an implantable medical device (IMD) for implantation in a patient, wherein the IMD comprises pacing circuitry configured to selectively produce pacing pulses at a programmable pacing rate for delivery to muscle tissue of a heart of the patient; and

wherein the IMD is adapted to receive the first signal from the programming unit and configured to subject the patient to a stress test dependent upon the first signal, and wherein during the stress test: (i) the pacing rate is increased from a start rate to a stop rate, wherein the stop rate is greater than the start rate, and (ii) stress test data is acquired and stored within the IMD.

44.   The system as recited in claim 43, wherein the first signal is a radio frequency signal.

45.   The system as recited in claim 43, wherein the first signal from the programming unit conveys timing information specifying a time the IMD is to subject the patient to the stress test, and wherein the IMD is configurable to subject the patient to the stress test at the time specified by the timing information.

46.   The system as recited in claim 45, wherein the timing information specifies a frequency and a time of day the IMD is to subject the patient to the stress test.

47.   The system as recited in claim 43, further comprising a patient activator configured to produce a second signal in response to input from the patient, and wherein the IMD is adapted to receive the second signal.

48.   The system as recited in claim 47, wherein the IMD is configurable to subject the patient to the stress test in response to the second signal.

49.   The system as recited in claim 47, wherein the second signal is a radio frequency signal.

50.   The system as recited in claim 47, wherein the IMD is configurable to abort a stress test in progress at a time the second signal is received.

51.   The system as recited in claim 43, wherein the IMD is configurable to detect at least one sign of myocardial ischemia within the patient during the stress test, and wherein the IMD is configurable to abort the stress test when the at least one sign of myocardial ischemia is detected within the patient.

52.   The system as recited in claim 51, wherein the at least one sign of myocardial ischemia comprises deviation of an ST segment of an electrogram (EGM) waveform from an isoelectric baseline.

53.   The system as recited in claim 43, wherein during the stress test, the pacing rate is monotonically increased from the start rate to the stop rate.

54.   The system as recited in claim 43, wherein the stress test data comprises electrogram (EGM) waveform data produced within the IMD.

55.   The system as recited in claim 43, wherein the IMD is coupled to receive a first intrinsic depolarization signal and a second intrinsic depolarization signal from the heart of the patient, and wherein the IMD is configurable to operate in a demand mode, and wherein in the demand mode, if the second intrinsic depolarization signal is not received within a predetermined time period, determined by the pacing rate, after the first intrinsic depolarization signal is received, the pacing circuitry is signaled to produce one of the pacing pulses.

56.   The system as recited in claim 43, wherein the programming unit is configured to send data to the IMD and to receive data from the IMD, and wherein the IMD is configured to send data to the programming unit and to receive data from the programming unit.

57.   The system as recited in claim 56, wherein during an initial portion of the stress test: (i) the programmable rate is programmed such that the programmable rate is increased from a start rate to a stop rate, and (ii) stress test data is acquired and stored within the IMD, and wherein during a final portion of the stress test: (iii) the programmable rate is programmed such that the programmable rate is decreased from the stop rate to the start rate, and (iv) the IMD is configured to provide the stress test data stored within the IMD to the programming unit.

58.   An implantable medical device (IMD) for implantation in a patient, comprising:

      pacing circuitry configured to selectively produce pacing pulses at a programmable pacing rate for delivery to muscle tissue of a heart of the patient;

      sensor circuitry configured to receive a signal from at least one sensor and to produce sensor data dependent upon the signal, wherein the sensor data comprises data indicative of an operational state of the heart of the patient;

      a memory for storing data; and

      a control unit coupled to the pacing circuitry, the sensor circuitry, and the memory, and wherein the control unit is configurable to store the sensor data in the memory until a trigger signal is received, and wherein the trigger signal is generated when the patient suffers from at least one sign of myocardial ischemia.

59.   The implantable medical device (IMD) as recited in claim 58, wherein the control unit is configurable to store the sensor data in the memory until the trigger

signal is received, and for a predetermined amount of time after the trigger signal is received.

60.   The implantable medical device (IMD) as recited in claim 58, wherein the sensor data comprises data required to reproduce the operational state of the heart of the patient.

61.   The implantable medical device (IMD) as recited in claim 58, wherein the control unit is configurable to store the sensor data in the memory such that when the memory becomes full, the control unit overwrites the oldest sensor data stored in the buffer with the newest sensor data.

62.   The implantable medical device (IMD) as recited in claim 58, wherein the control unit is configurable to analyze the sensor data to detect the at least one sign of myocardial ischemia within the patient, and to generate the trigger signal when the at least one sign of myocardial ischemia is detected within the patient.

63.   The implantable medical device (IMD) as recited in claim 62, wherein the at least one sign of myocardial ischemia comprises deviation of an ST segment of an electrogram (EGM) waveform from an isoelectric baseline of the electrogram (EGM) waveform.

64.   The implantable medical device (IMD) as recited in claim 63, wherein the at least one sensor comprises at least one intrathoracic electrode, and wherein the sensor data comprises intrathoracic electrogram (EGM) waveform data, and wherein the control unit is configurable to analyze the intrathoracic electrogram (EGM) waveform data to detect the at least one sign of myocardial ischemia within the patient.

65.   The implantable medical device (IMD) as recited in claim 63, wherein the at least one sensor comprises at least one intracardiac electrode, and wherein the sensor data comprises intracardiac electrogram (EGM) waveform data, and wherein the

control unit is configurable to analyze the intracardiac electrogram (EGM) waveform data to detect the at least one sign of myocardial ischemia within the patient.

66.   The implantable medical device (IMD) as recited in claim 58, further comprising a telemetry unit coupled to the control unit and configured to send and receive signals, wherein the trigger signal is received via the telemetry unit.

67.   The implantable medical device (IMD) as recited in claim 66, wherein the trigger signal is a radio frequency signal.

68.   The implantable medical device (IMD) as recited in claim 58, wherein the control unit is configurable to provide the sensor data stored in the memory.

69.   The implantable medical device (IMD) as recited in claim 58, wherein the control unit is configurable to use the sensor data stored in the memory to reproduce the operational state of the heart of the patient.

70.   A method for performing a stress test upon a patient having an implantable medical device (IMD) implanted within, wherein the IMD is adapted to receive information and configurable to subject the patient to a stress test at a time specified by timing information, the method comprising:

       configuring the IMD to subject the patient to the stress test at the time specified by the timing information; and

       conveying the timing information to the IMD.

71.   A method for performing a stress test upon a patient having an implantable medical device (IMD) implanted within, wherein the IMD is adapted to receive a signal and configurable to subject the patient to a stress test in response to the signal, the method comprising:

       configuring the IMD to subject the patient to the stress test in response to the received signal; and

       generating the signal.

72.   A method for reproducing an operational state of a heart of a patient having an implantable medical device (IMD) implanted within, wherein the IMD is configurable to store sensor data in a memory until a trigger signal is received, and to use the sensor data stored in the memory to reproduce the operational state of the heart of the patient, the method comprising:

> configuring the IMD to store the sensor data in the memory until the trigger signal is received;
>
> generating the trigger signal; and
>
> configuring the IMD to use the sensor data stored in the memory to reproduce the operational state of the heart of the patient.

73.   A method for performing a stress test upon a patient, comprising:

> programming an implantable medical device (IMD) with stress test values, wherein the IMD is implanted in the patient and configured to provide pacing pulses to a heart of the patient; and
>
> signaling the IMD to initiate the stress test.

74.   The method as recited in claim 73, wherein the programming comprises:

> programming an implantable medical device (IMD) with stress test values, wherein the IMD is implanted in the patient and configured to provide pacing pulses to a heart of the patient, and wherein the stress test values comprise a start rate value, and wherein the start rate value specifies a starting rate at which the IMD provides pacing pulses to the heart at a beginning of the stress test.

75.   The method as recited in claim 73, wherein the programming comprises:

> programming an implantable medical device (IMD) with stress test values, wherein the IMD is implanted in the patient and configured to provide pacing pulses to a heart of the patient, and wherein the stress test values comprise a stop rate value, and wherein the stop rate value

specifies a maximum rate at which the IMD provides pacing pulses to the heart during the stress test.

76.   The method as recited in claim 73, wherein the programming comprises:

programming an implantable medical device (IMD) with stress test values, wherein the IMD is implanted in the patient and configured to provide pacing pulses to a heart of the patient, and wherein the stress test values comprise a rate-of-change value, and wherein the rate-of-change value specifies a rate at which the IMD is to increase a heart rate of the patient during the stress test.

77.   The method as recited in claim 73, further comprising:

recording data associated with operation of the heart during the stress test.

78.   An implantable medical device (IMD) for implementation in a patient, comprising pacing circuitry configured to selectively produce pacing pulses at a programmable pacing rate for delivery to cardiac tissue of the patient being in operative electrical and data communications with an external device, and wherein the external device is configurable to subject the patient to a stress test, and wherein during the stress test: (i) the pacing rate is increased from a start rate to a stop rate, wherein the stop rate is greater than the start rate, and (ii) stress test data is acquired and stored in the external device.